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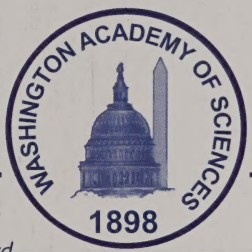

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EDITOR'S COMMENTS

Presenting the 2021 summer issue of the *Journal of the Washington Academy of Sciences*.

Please stay safe in this time of the pandemic. Right now your best bet is to get the vaccine and wear a mask. We do not get much international news; however, I learned from my physician that the lambda variant of covid has surfaced in Peru which now has the highest death rate in the world – about 600 covid deaths per 100,000 people. Do your best to be a solution and not a problem.

There are three papers in this issue. There is no science bite.

The first paper is on the science of music theory. I learned about Kant and music theory as evidenced by nineteenth century music critics. The second paper is a radio astronomy paper that used citizen science for some of the work. The third paper is highly speculative about the possibility of a fifth force of nature.

The *Journal* has been the official organ of the Academy for over 100 years. It is a continuing struggle to find papers to publish. The deadline for submission of papers for the Fall 2021 issue was 1 August. No papers were received. It is likely that there will be no Fall issue.

I encourage people to write letters to the editor. Please send by email (wasjournal@washacadsci.org) comments on papers, suggestions for articles, and ideas for what you would like to see in the *Journal*. I also encourage student papers and will help the student learn about writing a scientific paper.

Sethanne Howard

Journal of the Washington Academy of Sciences

Editor Sethanne Howard showard@washacadsci.org

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IMPURE THEORY OF PURE MUSICAL FORM: ROMANTIC LEGACY AND CRITICAL TASK IN EDUARD HANSLICK'S *ON THE MUSICALLY BEAUTIFUL*

Francesco Ragni

Dipartimento di Filosofia, Comunicazione e Spettacolo, University of Roma

ABSTRACT

Eduard Hanslick is a celebrated music theorist. His writings come at a time of transition from romanticism to the new science of music. The aim is to point out and separate these two distinct sources within Hanslick's treatise, recording where they coincide and where they diverge.

INTRODUCTION

AMONG THE NINETEENTH CENTURY MUSIC THEORISTS, who were most esteemed and still considered and discussed today, Eduard Hanslick (1825-1904) emerges as the most celebrated one. Much of his enduring fame stems from his brief treatise on aesthetics, although his energetic aversion to Richard Wagner's art also greatly contributed to spread his name. The incongruities – which have been already pointed out by other scholars[1] – between the principles he enunciated and his verdicts as a militant critic do not however interest us: they pertain to the history of musical criticism, not to philosophy.

Another circumstance is worthy of philosophical attention: Eduard Hanslick's personality recapitulates an epochal transition in music, as well as its ambiguities. His aesthetics develops at the convergence of theoretical debates of various origin and orientations, which, when not conflicting, did not incline to a spontaneous conciliation. On the one hand, his writings come at a time that experienced the new science of music (*Musikwissenschaft*), influenced by positivism; on the other hand, his answer to the problem of music, of its position and meaning within the culture, comes after the vigorous concern that this topic had manifested itself in nineteenth-century Romantic culture.

One might therefore ask which of these two speculative influences prevails over the other. We must make it clear from the beginning, anticipating our conclusions: the answer to this question is not unequivocal.

Johann Friedrich Herbart undoubtedly influenced Hanslick[2]. This was *in nuce* the Herbartian lesson for the aesthetics: art is form, not expression, its value relies upon the work's formal qualities, empirically definable, while the emotional contents must not influence our judgment.

Hanslick develops with more coherence and penetration the concepts of Herbart's aesthetics, which are already set apart from idealistic generalizations in attempting to root out the formal qualities in the empirically observable evidence. Yet, besides Herbart's directly identifiable influence, *On the Musically Beautiful* reveals other influences, which are no less significant. Among the most relevant, yet indirect, we find Kant's *Critique of the Power of Judgment*, as well as a group of heterogeneous stimuli, which also include Hegel's *Aesthetics* and E. T. A. Hoffmann's critical writings.

Our aim in this paper is to point out and separate these two distinct sources within Hanslick's treatise, recording their points of contact and divergence, from which a complex picture emerges

THE ROMANTIC INFLUENCES

The objective foundation of Beauty

In the second half of the nineteenth century positivism undermines the idea of the convergence of all the arts, which was established on the psychic effect. Efforts in investigation turn to the physical side of art, to its technique, which from a simple means becomes an end: the artistic beauty no longer involves the sphere of sentiments. Under the influence of the contemporary development of evolutionism and psychology, research on music is forced to a compromise with the sciences. The studies of acoustics, musical historiography, paleography, and psychology emerge out of this background: priority is now given to the empirical investigation of music's peculiar aspects.

From the perspective of the history of philosophy Hanslick's theory stands at the point where the romantic theories of art combine with the post-Hegelian rediscovery of Kant's critical essentialism[3]: Kant's doctrine helps translate the romantic idea of music from a metaphysical to a scientific base. This idea, according to which the pure aesthetic form is not a mere development of empty and meaningless thoughts (*i.e.*, it is not passively

waiting for a meaning to fill it), is now aimed at a coherent application in music's investigation.

Yet Hanslick's method is based on a non-Kantian principle: "in aesthetic investigations the beautiful *object*, not the perceiving subject, must first be investigated"[4]. We must not be misled into interpreting this statement as one of the many lashes against the aesthetics of sentiment: it rather tells us that sensation is the mere subjective determination of an objective cause, where every beauty must be definable on an objective ground. The judgment on beauty, which Kant defines as a 'judgment of taste' (*Geshmaksurteil*), says nothing about the object but only talks about the state of the subject. For Hanslick the judgment on beauty must tell us something about the object: not only about its very general properties, but also about its particular ones. Hanslick is certainly not the first to raise such an objection: Johann Gottfried Herder already rejected Kant's subjectivism for an aesthetic analysis of objects (*aesthetische Gegenstandsanalyse*)[5]. But in addition to that of 'autonomy', the beauty's objectivity also presupposes the concept of 'limitation'. Hanslick shares with the early German Romantics the need to judge the work of art by a principle, which must not be sought beyond its own boundaries. Friedrich Schlegel already conceived the idea of a precise intrinsic organization of the work of art in the place of abstract conformity to rules. But the necessary *pendant* to this intrinsic construction is a concept of criticism to which Hanslick was completely unfamiliar.

For him criticism is not an experiment in the work of art itself, through which it is awakened to its reflection and thus brought to self-knowledge. It is rather a question of undertaking a critique as a rigorous foundation of objective principles through definitions: if there is a possibility of objective explanation of music, this explanation does not reside in general aesthetic hypotheses, but in a study of the scientifically considered musical object.

In searching for a scientific approach Hanslick's position is not free from contradictions: on the one hand, the aesthetics of the 'specifically musical' (*das spezifisch Musikalische*) has its model in the early Romantics, for whom music represents a perfectly autonomous world of its own. On the other hand, if the romantic conception of art, as an expression of the 'absolute', initially allows us to consider music, like poetry, an art of contents – because both express the 'spirit' –, then its almost immediate

consequence it assumes music as a simple means through which ideas come to expression, since that content does not essentially belong to it[6].

The polemical intention of Hanslick's brief treatise is after all clear from its very title: it tells us that there is a specific beauty of music, distinct from the universal category of beauty. This conviction equally contradicts the idealistic metaphysics of art and the romantic idea of a unification of arts, which contain the 'spirit' (*Geist*) in a greater or lesser extent.

The instrumental music's supremacy

Another connection with the Romantic legacy presents a more significant concept to our attention. The relevance Hanslick gives to instrumental music over vocal music associates him with E. T. A. Hoffmann, who was the first to indicate instrumental music as the example, from which it was possible to trace back to its aesthetic autonomy:

> When we speak of music as an independent art, should we not always restrict our meaning to instrumental music, which, scorning every aid, every admixture of another art (poetry), gives pure expression to music's own nature, recognizable in this form alone?[7]

Hanslick's position reflects in these statements in a quite detailed and precise way, both in the use of the terms and in the broad conceptual aim:

> We have deliberately chosen instrumental phrases as examples. Because only what can be said of instrumental music is true for musical art as such. If any general determinateness of music is investigated, something like this should characterize its essence and nature, determine its limits and direction, then it can only be instrumental music. What instrumental music cannot do, it must never be said of what music can do; because only it is the pure, absolute musical art.[8]

This does not mean, however, that vocal music is not as aesthetically relevant as instrumental music:

> In vocal composition we have an inseparably fused product from which it is no longer possible to determine the amount of the individual factors. When it comes to the effect of poetry, it will never occur to anyone to emphasize opera as an evidence; it takes a greater denial, but only the same insight, doing the same with the fundamental determinations of musical aesthetics.[9]

The instrumental music's supremacy argument – which Romantics often used with polemical intentions – achieves a critical significance in the search for the 'specifically musical', which distinguishes both from other

arts' subjects and verbal contents. In Hanslick this research finds the first adequate definition in terms of an aesthetic theory where the German Romantics expressed ambiguous and contradictory opinions on the nature of music and its relationship with other arts and criticism.

With his review of Beethoven's *Fifth Symphony*, Hoffmann inaugurated an investigation no longer conceived as a description of music in terms of the Enlightenment theory of effects: the musical investigation begins with the necessary observation of its actual development. At the end of the romantic parable Hanslick develops these tendencies into a coherent thought. Before his work the idea of an exclusively musical content has been only mumbled without being clearly spoken.

Hanslick's idea of musical content as 'tonally moving forms' ('*tönend bewegte Formen*') is not however the exclusive result of a pure theoretical development. It is not conceivable without the renewal, which took place starting from the end of the eighteenth century, of both music and aesthetics were emancipated from the linguistic contents and constructive principles of the poetic-dramatic arts. Although this emancipation had the effect of moving away, in the compositional practice, from the musical forms related to verbal expression, it later paid attention to the constitutive principles of art, regardless of the fact that music composed on their basis was linked to the words.

Hanslick interpreted the Romantics' metaphysics of the symphony as an aesthetic of the 'specifically musical', which did not overlook – as metaphysics did – the concern to justify the musical forms' historical development: this justification should have been grounded on its aesthetics as its necessary condition.

However, we cannot easily admit that he assumed a coarse empirical attitude conforming to the disenchanted atmosphere after Hegelianism's fall. The emphasis Hanslick gave to the concept of 'spirit', a quite non-empirical concept indeed, makes that remark doubtful: "composing is the work of the spirit on a spiritually capable material"[10]. This statement is far from being immediately clear: if we leave the concept of 'spirit' undefined, it assumes different if not conflicting meanings.

'Spirit': in search for a definition

Hanslick's suspiciously frequent use of the term '*Geist*' was bound to go not unnoticed. The German musicologist Carl Dahlhaus already brought this occurrence to the conscious attention of critics[11]. The circumstance could perhaps have been ignored, if Hanslick had not used the term in a – to say the least – categorical definition: "we acknowledge no beauty without spirit [*Geist*]"[12]. The relevance of this statement is equal only to its semantic ambiguity. Looking at the entire passage from which we took this statement, we can understand how equivocal can be the word 'spirit', which here occurs several times and in different meanings.

This ambiguity is not however entirely ascribable to Hanslick: it rather reflects an ambiguity that is characteristic of an entire linguistic tradition. Although it is not in our intentions to address a broad historical perspective, a brief incursion into this sphere is necessary.

As '*logos*' in the ancient thought, in the modern German philosophy '*Geist*' is a polysemic expression: it conveys different meanings in different stages of its historical development. A univocal translation is therefore almost impossible: it can mean 'spirit', 'mind', as well as the two meanings together. Typically, it denotes an intellectual experience, which refers to transcendence. In relation to the arts it assumes a specific significance: we perceive beauty through the senses, but it is never entirely there and 'all at once' there. In the experience of beauty there is always something exceeding it, that is not part of the experience as such, to which it refers as its intermediary.

As a historical determination of musical forms, otherwise engaged in an abstract combinatorics of immutable principles, Hanslick's concept of 'spirit' certainly suggests its origins in Hegel. While entirely absent in Kant, in Hanslick we find traces of a historically justified conception of beauty – which was implicitly enfolded in Friedrich Theodor Vischer's late-idealistic consideration of the arts' material aspect. In defining beauty as the sensible manifestation of the idea Hegel recognized in the arts a disclosive function: artistic forms are the spirit's historical manifestations.

The comparison stops however almost immediately. Hanslick radically disagrees with Hegel in conceiving music's intellectual significance. Indeed this disagreement involves the question of what 'spirit'

means: shaping musical forms is a work of the 'spirit', a search for the most appropriate configuration for a peculiar and untranslatable idea, which precisely through this configuration becomes for the first time understandable[13]. 'Spirit' indicates in Hanslick an ability that expresses in music, it cannot be conceived as an extraneous spirituality or ideality: the meanings it produces are intrinsic. These considerations, as well as the lack of a universalistic theory of history in Hanslick, which would adequately sustain such views, suggest we look elsewhere for our definition.

The infinite feeling beyond language

In Hanslick's openly anti-romantic theory there was also a connection with the romantic idea of music as a supreme art: free from the contingent contents of the external world, music expresses what is most free from outer conditionings. Before his work W. H. Wackenroder conceived music as an isolated world. Music is the medium of pure sentiment that the concept cannot translate in any way, although it is not entirely untranslatable from the word, which participates in it in the forms of poetry (but, precisely, in its forms, not in its object: an anti-formalist consideration of music opens the way to the formalism to come).

Wackenroder sees in music the highest moment of art, the one in which the human spirit, overcoming the sensitive constraints existing for the other arts, penetrates into its own interiority, capturing otherwise inaccessible aspects of life. Music thus offers us sentiment, as it is in itself, untranslatable into words. Wackenroder's reflection, for this reference to the sentiment in itself, to the ineffable marks the beginning of the German Romanticism's turning point: the expressive capacity of music was acknowledged in referring to a sentiment that is not empirical, specific, but universal and transcendent.

For the eighteenth-century's previous theorists it was self-evident that if music was to be considered as a language, that language could only be that of effects. Arthur Schopenhauer took this thought to its extreme consequences: musical language is not confused and indistinct, but on the contrary proves to be superior to verbal language, it is immediately understandable, as it does not need the mediation of concepts[14].

Hanslick believed that in the musical connection, as expressive objectivity, takes place in the transfiguration of subjective spiritual

processes. The individual psychic experience, from which the expression arose, has no musical significance: in expressing itself it becomes opaque, making it impossible to trace a precise correspondence between the elements that constitute it and those contents. Although the emotional aspect represents an attribute of the listening experience, it is far from being considered, according to Hanslick, as its decisive aspect: this proves instead to depend on an objective foundation that musical aesthetics can only identify if it abandons not the emotion as such, but the prejudice that elevates it to the ultimate aim of aesthetic contemplation. In the controversy against the 'degenerate aesthetics of sentiments' (*verrottete Gefühlsästhetik*) the psychic experience is not in question, only its aesthetic relevance.

This is the thesis that justifies his position: music is unable to express indeterminate feelings. The very designation 'indeterminate expression' (*unbestimmte Ausdruck*) is for Hanslick a contradiction in terms: an expression is determined by definition. And yet, although it is a determined expression, music is not able to express determined feelings, since their determinateness would be possible only through concepts. The 'conceptual essence' of emotions cannot be portrayed by music. Certainly, we could revoke this last postulate in doubt: in fact, it is among those that makes Hanslick's theses more debatable[15].

Hanslick thinks of determinateness as a property of the concept, bringing him closer to Kant: the "determinacy of feelings cannot be separated from concrete representations and concepts, which do not fall within the expressive capacity of music"[16]. In this statement the determinacy is still thought in the form of a transcendental schematism, where concepts dominate over intuitions and imagination plays an ancillary role (which contradicts its cognitive and practical relevance through the whole treatise).

The primary and macroscopic critical task, to refute once and for all the aesthetics of effect, unintentionally assigned Hanslick to the same implicit presupposition of that one: the dualism between expression and the contents of the conscience. Both the eighteenth-century aesthetics of affects and the Romantics' aesthetic of sentiment respond to this dualism, with a significant difference: the former seeks that extraneous content in the finitude of the human world (more precisely: in the social relations), the other in a transcendent infinity.

THE CRITICAL APPROACH

Form and Beauty

In the nineteenth century Kant's theory of judgment became an unavoidable reference for every following theory of art: a reference as unavoidable as regularly misunderstood. If it was the first to include a reference to 'autonomy' (*Autonomie*), and has often been described as a 'formalist' theory, we cannot however disagree with Carl Dahlhaus when he observes that "Kant's conception of 'form' is so different from Eduard Hanslick's that referring to both in the same phrase is misleading"[17]. One might believe that this depends on a correspondence, in Kant, between the aesthetic and cognitive formalism: 'form' is antithetical to 'content' (*Inhalt*) and 'matter' (*Materie*).

If we aim to discover a connection between Hanslick's idea of 'form' and that of Kant, this connection could perhaps be established on the broader gnoseological perspective rather than strictly on the aesthetic one[18]: in determining empirical contents, both Kant and Hanslick focus on formal properties. Still, Kant's approach lacks that idea of a 'musical logic' (*musikalisches Logik*), which to Hanslick is – to say the least – central.

To escape the narrow limits that Kant traced around the concept of 'beauty', almost useless to the need for a systematic philosophy of art – which already existed before Hegel, but consolidated with him –, aesthetic systems were produced that attempted to extend this concept through its specification. Hanslick belongs to this general movement of aesthetics' emancipation through its specification. Thus, not only was there talk of a 'characteristic beauty', but also an attempt was made to involve its antithesis, the 'ugly', as a partial moment of a dialectic of beauty, justified within a thought which, although different in its content, was always Hegelian in its structure.

The most immediate relation between Kant's critical philosophy and Hanslick's aesthetics seems, however, to begin within the specific problem of aesthetic judgment, *i.e.*, with the definition of what 'beauty' is. According to the category of quantity, "the beautiful is that which apart from concepts is represented as the object of a universal satisfaction"[19].

Although it is possible to trace in Hanslick's treatise definitions corresponding to the other moments of the judgment of taste (namely:

quality, relationship, and modality), the definition according to the category of quantity was certainly the most appropriate to support the *pars destruens* of his treatise, which prevails over the *pars construens*: as the object of the aesthetic faculty of judgment, musical works are not defined by the logical-discursive categories and maintain their autonomy with respect both to concepts and linguistic expression.

Still, the concept of autonomy that we could derive from it shows a lack of determination. If grounded exclusively on the judgment of taste (*Geschmacksurteil*), aesthetics recognizes art as its object as one among others. If we must conceive, as Hanslick does, aesthetics as a specific investigation into art, grounded on artistic judgment (*Kunsturteil*), we must assume music as a phenomenon with peculiar characteristics within a specific theory. Yet, on a closer look, not only the definition of aesthetic judgement but also the very definition of artistic judgment in Kant appears to be still too generic to allow such theory.

In confronting Hanslick's aesthetics with Kant's doctrine – which, we must remark it, in none of its sections must be understood as an aesthetics – a twofold clarification is required: we must distinguish the judgment of taste from the judgment of art; then, on the basis of this distinction, we can question the position Kant assigns to music in respect to the other arts, since that distinction could still allow an aesthetic theory within which music is not a mere game of sensations.

The conflict between the judgment of taste and artistic judgment, between intuitions and ideas, reveals the deeper conflict between aesthetics as a general theory of knowledge and an aesthetic as a philosophy of art in the narrow sense – that is, a philosophy capable of grasping what is 'ideal' and 'spiritual' in the arts.

As Dahlhaus already pointed out, the distinction between judgment of taste and artistic judgment is necessary to resolve the contradiction in the *Critique of the Power of Judgment*, between §15 and §48. If Kant states that the judgment of taste is entirely independent of the concept of perfection, in determining what relationship the first establishes with genius, he corrects his first considerations:

> [...] If the object is given as a product of art, and is as such supposed to be declared to be beautiful, then, since art always presupposes an end in the cause (and its causality), a concept must first be the ground of what the thing is supposed to be, and, since the agreement of the manifold in a thing with its inner determination as an end is the perfection of the thing, in the judging of the beauty of art the perfection of the thing will also have to be taken into account, which is not even a question in the judging of a natural beauty (as such).[20]

If we must judge only on the basis of perceptions, *i.e.*, aesthetically, Alexander G. Baumgarten's definition of beauty as 'perfection of sensible knowledge' (*perfectio cognitionis sensitivae*) becomes contradictory. Every perfection is connected to the concept of what the object must be; but at the same time this concept should be given previously and independently of any perception of the object, therefore before any judgment through which its knowledge becomes possible in the first place.

We must evaluate beauty according to perceptions, not to concepts. This idea is closely connected in Kant with the search for the conditions of possibility of the faculty of judgment: it brings him to search for beauty in nature, not in the arts.

When translated into an art's theory, this idea disproves a mannerist conception, according to which works of art can be produced as utensils are produced, *i.e.*, following rational representations. Yet it has also encouraged the confusion between artistic judgment and taste judgment in interpreting Kant: it is in fact the teleological judgment that becomes the aesthetic judgment's foundation and condition when it relates to a work of art.

If, in the judgment of only taste, an object is qualified as 'beautiful' based on the feeling of pleasure or displeasure in the free play of the cognitive faculties, the artistic judgment uses instead the work of art as its object: not in its technical perfection or imperfection, but in adherence to the representation that made possible its production. This representation cannot be however a concept of the intellect, since it would ground the judgment of objects that are not works of art. Yet it cannot be an idea of reason either, since no sensible display would be possible for it.

Kant distinguishes 'free beauty' (*pulchritudo vaga*) from 'dependent beauty' (*pulchritudo adhaerens*). Free beauty "presupposes no concept of what the object ought to be", while dependent beauty "presupposes such a concept and the perfection of the object in accordance with it"[21]. Now, music

without a text is for Kant an example of the first kind of beauty: it expresses nothing defined, has no meaning, and therefore is evaluated by the pure judgment of taste, *i.e.*, "according to the mere form"[22].

Following Rousseau, Kant considers 'absolute music' the "language of the effects"[23]. Its capability to present contents is limited to aesthetic ideas, which are "combined in a natural way"[24] with effects. Unlike literary and visual arts, it speaks entirely through sentiments, without concepts: there is nothing in it, on which the mind could reflect. Consequently, music is placed between the subjective 'agreeable' (*angenehme*) and the actual beauty, which claims a universality shared among different subjects. This median position – as result of its congenital foreignness to language and concepts – will find a direct correspondence in Hegel's *Aesthetics*.

Although for Kant music without a text is a mere play of sensations, he nevertheless considers instrumental music as music in the proper sense. As for Hegel, music loses any content, as well as every cultural value, at the very moment in which it presents itself in its pure form, as an '*absolute Tonkuns*' (to be understood here in the narrow, etymological sense of the word, '*absoluta*', free from the bond with language and concepts). Therefore, since fine arts depend upon ideas and rational concepts, Hanslick's concept of 'pure music' does not seem to meet Kant's definition. Beauty is divested of its subordinate correlation to ideas and the moral sphere: pure music is a self-referential, syntactical structure built from its peculiar logical grammar.[25]

Musical idea and aesthetic idea

If we must not connect Hanslick's aesthetics of music to the *Critique of judgment* through the concept of 'beauty', it has to be asked whether this connection is justifiable through the other concept, with which Kant defines the experience of art, that of 'aesthetic idea'. Also, Hanslick's investigation's main notion – '*schön*' (the beautiful) or '*das Schöne*' (the beauty) – might appear contradictory when observed exclusively from the standpoint of Kantian beauty, as it describes both the aesthetic, subjective features of art and its ideal, objective contents.

Robert Schumann's declaration that "every art has the same aesthetics, only the material is different"[26] is for Hanslick unacceptable: "The laws of beauty in every art are inseparable from the peculiarities of its material, of

its technique"[27]. Yet, only by remaining on the surface the meaning of Hanslick's operation can be reduced to the identification of art with its specific technique. The Kantian ground underlying his enquiry suggests that this paradox be judged as a mere appearance: the concept of 'beauty' stated that aesthetic universality is built starting from perception alone, without the mediation of concept, and therefore also in the absence of such specific technical knowledge.

The relationship of an art with its material does not concern the expression of the idea as an 'absolute' (*i.e.*, 'transcendent', in the romantic-idealist meaning). It rather decides on the very nature of aesthetic ideas that can be expressed in one art rather than another. A consequence of this principle is that a hierarchy of arts has no meaning: just as the materials are incommensurable to each other, so are the aesthetic ideas they express. The thesis of a specific beauty of music is also certainly justified by a materialistic conception, which neither dissolves nor is dissolved when coming in contact with surviving idealistic tendencies in the philosophy of the second half of the nineteenth century.

Conceived in relation to natural phenomena, the concept of 'beauty' is for Kant independent from a spiritual content, while for Hanslick it is only conceivable as a 'spiritual beauty' (*geistige Schöne*):

> Nothing is more erroneous and more common than the view, which distinguishes a 'beautiful music' with and without spiritual content. It grasps the concept of the beautiful in music far too narrowly and imagines the artfully assembled form as something that exists for itself, and likewise the instilled spirit as something independent.[28]

However, in the third *Critique*'s paragraphs, in which the doctrine of genius is exposed, Kant seems to allow the possibility of an art that does not possess the character of beauty: if taste has a constitutive function for natural beauty, in artistic creation its function is only a regulatory one. 'Taste' (*Geschmack*), which has 'beauty' as its correlative, assures the communication of aesthetic ideas. In relation to artistic beauty, understanding means grasping, at the same time, the universality of an art that is beautiful and a beauty that is art. An art devoid of the character of beauty would also lack the necessary aesthetic universality, through which becomes possible the transition to the logical-discursive universality investigated in the first *Critique*.

In outlining the cognitive relationships that allows the exhibition of aesthetic ideas, Kant shows how imagination takes charge of such exhibition, freely referring the sensible forms to the intellect,in such a way that this latter can never fix their regularity, despite being forced to find one. Imagination plays a similar role in Hanslick: "the organ, with which we the beautiful is perceived, is not the feeling, but the imagination, as the activity of pure contemplation"[29]. However, only to a superficial reading this statement agrees with Kant's position.

The concept of a 'musical beauty' adequately clarifies itself if we recognize that the musical idea cannot be given separately from its form: the aesthetic understanding through imagination must grasp the idea, but this, far from not being representable in the same way that an idea of reason cannot be represented, must be sought within the musical forms themselves.

If, on the one hand, for Kant the form of art is beauty, in which only the aesthetic idea can reach its adequate expression, Hanslick, on the other hand, makes no difference between form and idea: "a musical idea that has been fully brought to light is already an independent beautiful [...]".[30] Kant maintains the Platonic distinction between sensitivity and reason: as the Platonic ones, Kant's ideas are located outside the sphere of sensible experience. However, if the idea of reason is a concept for which no sensitive intuition can be adequate, the aesthetic idea is

> a representation of the imagination that occasions much thinking without it being possible for any determinate thought, i.e., concept, to be adequate to it, which, consequently, no language fully attains or can make intelligible [...] One easily sees that it is the counterpart (*pendant*) of an idea of reason, which is, conversely, a concept to which no intuition (representation of the imagination) can be adequate.[31]

Of course, the sensitive nature of the aesthetic idea might at first suggest us to discover its counterpart in the 'tonally animated forms'. However, in Kant the aesthetic idea generates the work of art, but it does not immediately make it possible as such: the artist presents a specific image – which Kant defines as an 'aesthetic attribute' (*ästhetisches Attribut*) – since he cannot directly represent the idea, located beyond the sphere of sensitivity. That could also be formulated in other terms: the aesthetic ideas are ineffable. Kant conceives the aesthetic ideas as mediators between rational ideas, on the one hand, and sensibility and imagination on the other.

A work of art expresses an aesthetic idea in so far as it gives sensible form to a rational idea.

A nexus of derivation and subordination inevitably emerges: aesthetic ideas seek to approximate an exhibition of rational ideas. Hanslick's theoretical efforts are aimed at the refutation of this nexus: any attempt to reconcile the two views appears therefore impractical.

CONCLUSIONS

What in the first place emerges from our brief survey is that Hanslick cannot be easily traced back to a school or a doctrine: he did not pay to anyone a tribute of exclusive intellectual dependency. More specifically, we could say that Kant's criticism provided him the essential method through which he comprehended and organized Romanticism's thesis, detaching them from the anarchic contradiction of the previous tendencies[32].

Hanslick was the first to attempt an order where previously reigned confusion. Beyond the inconsistencies, and through them, his unitary project emerges stronger rather than weaker. The attention of the critics, at first always focused on macroscopic errors, in the late twentieth century has turned to what can serve as a foothold for continuing on the same path. Susanne Langer[33] and more recently Peter Kivy[34] – with his 'enriched formalism' theory – demonstrate that our time has offered not only the most adequate premises for an impartial, yet sterile, reconsideration of Eduard Hanslick's thought, but also for its development.

Nonetheless, this theory's implicit methodological principle – form can be described through empirical features – encompassed an *aporia*. This *aporia* is reflected by Hanslick's treatise when we try to consider it as a whole. The contradictions it produces are more evident to the critic the more he understands the distance that separates the problematic sphere from the resolutive one, the questions Hanslick raised from the answers he gave us.

His theory, however, still awaits its ultimate falsification, since this falsification is demanded by the decisive question set at its center, in front of which the theory proves to be insufficient more than inadequate: how can form preside over the creation of non-formal qualities?

The form-content antagonism has been often criticized as a false dichotomy, especially when it came to concern music. The theorists

commonly solved this antagonism by describing music as structure, in pseudo-mathematical explanations. Hanslick however provides us with a more complex view:

> Many aestheticians consider that the enjoyment for regularity and symmetry sufficiently explains the musical pleasure, though the beauty, moreover the musical beauty, never consisted in those. The most trivial theme can be constructed in a perfectly symmetric way. 'Symmetry' is indeed only a relational concept and leaves open the question: "What it is, then, that appears symmetrical?"[35]

Hanslick belongs to the nineteenth-century aesthetics' school that overcomes the contrast between Herbartian formalism and Hegelian contentism (in which form and content are in a dialectic relation), giving outlining a more complete theory of art, which brings the synthesis of form and content to identity. This identity not only detaches the musical content from linguistic-conceptual determinations – shifting the center of gravity on the formal side – but it has also the advantage of rescuing the form from the abstract, affirming the need for an autonomous content. The close correlation between form and content does not allow a theory of music as mere description of empty structural schemes.

Hanslick will be then misunderstood if we consider his theory of 'musical beauty' as a pure formal aesthetic. He is not the musical formalist the traditional analyses often depict: he too provides a content to music, yet this content has to be musical. A pure formalist approach – which is acknowledged in Hanslick as its theoretical foundation and justification – fails to develop the implications of Hanslick's position on expressiveness in music as it appears not only in *On the Musically Beautiful* but also in his published musical criticism and reviews. Indeed, by arguing that music refers only to itself as unity of form and content, that it has meaning as a product of the mind in shaping the musical material, a strict formalism does not yet resolve music's referentiality issue. If we consider the aesthetic principle of 'musical beauty' as a pure logical system of relations, which the concept of 'arabesque' epitomizes, it reveals undetermined and inadequate to any explanatory intention.

Contemporary research has committed to emancipating Hanslick from the limiting formalist view. However, correctly understanding him – especially in the Anglo-Saxon area, is mostly analytically oriented – it is not helped by the predominant psychological approach, which has led to

ignoring the cognitive specificity Hanslick assigns to imagination in favor of a physiological reductionism obsessively focused on the *vexatissima quaestio* of the feelings' expression. Kivy's position seem to exemplify this quite well: "'enhanced formalism' is [...] an enhancement of Hanslick's formalism, allowing it to include emotive properties as perceptual properties of the music"[36]. However, that does not explain at all what kind of artistic value lies in these properties, and why art should be preferable to gastronomy. Not to mention that in such theories the concept of 'feeling' never goes through a preliminary critic that explains it.

It must not be never forgotten that Hanslick justified his formalism by connecting the musical understanding to imagination, as the faculty that enables the composer to choose beautiful combinations of tones, as well as the faculty that allows the listener to understand them:

> The most important factor in the mental process that accompanies the comprehension of a musical work and makes it enjoyable is most frequently overlooked. It is the intellectual gratification that the listener finds in continuously following and anticipating the intentions of the composer, here to have his expectations confirmed, there finding him pleasantly misled. It goes without saying that this intellectual streaming hither and thither, this continual give and take, unfolds unconsciously and lightning fast. *Only such music that evokes and rewards this intellectual tracing – which could actually be called a reflection of imagination – will offer full artistic enjoyment.*[37]

The statements that appeared at the beginning of the treatise are now clarified and deepened:

> Art is primarily for representing something beautiful. The agency by which the beautiful is received is not feeling but rather imagination [*Phantasie*], as the activity of pure viewing.[38]

It is indeed in the primacy of imagination over sensations and emotions that the two speculative influences we outlined in Hanslick could perhaps find a point of convergence. Imagination – which he calls 'fantasy' (*Phantasie*) – is the specific organ of art, through which Hanslick aims to overcome the problem that has engaged both Kant and the romantics: the antithesis between intellect and impressions.

As the organ of production and contemplation of art, it has boundaries but it is not a 'closed field': "in front of the beautiful, imagination [*Phantasie*] is not pure and simple 'contemplating', but contemplating with 'intellect', that is, representation and judgment"[39]. The choice of terms

makes the allusion to critical philosophy quite evident. Through imagination music connects itself, in Kantian way[40], to spheres of knowledge and experience in which its form cannot be directly involved as their representation, also addressing the romantic ideal of arts' mutual relationship without sacrificing their autonomy: the imagination "draws its vital sparks from the sensations, so it sends its rays to the activity of the intellect and of the feeling"[41].

In the light of these clarifications, the problem of content and meaning of music must be discussed within a broader theory of imagination, which also comprehends music's relations to history, beyond the mere progression of composition's techniques. Formalism, with or without Hanslick, theorizes a complex value and function of music. If in formalist theories the objective representation has no right of citizenship, that doesn't concern the imagination and the imaginary.

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Notes

1 Cfr. D. GOOLEY, *Hanslick and the Institution of Criticism*, in 'Journal of Musicology', no. 28/3 (2011), pp. 290-325.

2 Cfr. A. WILFING, *Hanslick, Kant, and the Origins of Vom Musikalisch-Schönen*, in 'Musicologica Austriaca: Journal for Austrian Music Studies' (June 18, 2018), http://www.musau.org/parts/neue-article-page/view/47, accessed on 22 Jan. 2021.

3 For a historical reconnaissance of German philosophy's development in the nineteenth century cfr. K. C. KÖHNKE, *The Rise of Neo-Kantianism: German Academic Philosophy between Idealism and Positivism*, translated by R. J. Hollingdale, Cambridge University Press, Cambridge 1991, p. 108 ss.

4 E. HANSLICK, *Vom Musikalisch-Schönen. Ein Betrag zur Revision der Ästhetik der Tonkunst*, achte vermehrte und verbesserte Auflage, verlegt bei J. A. Barth, Leipzig 1891, p. 4 [from now on *VMS*]; Eduard Hanslick's on the Musically Beautiful: A New Translation, edited and translated by L. Rothfarb and C. Landerer, Oxford University Press, Oxford 2018: «daß in ästhetischen Untersuchungen vorerst das schöne Object und nicht das empfindende Subject zu erforschen ist».

5 Cfr. R. KÖHLER, *Johann Gottfried Herder und die Überwindung der musikalischen Nachahmungsästhetik'* in 'Archiv für Musikwissenschaft' 52, no. 3 (1995), pp. 205-219.

6 Extending it to every form of expression, Schopenhauer's metaphysics of art fully develops this thought: in his inverted Platonism, the idea of Beauty could exist without the need to be sensibly represented (Cfr. S. SHAPSHAY, *Schopenhauer's Aesthetics and Philosophy of Art*, in 'Philosophy Compass', 7(1), January 2012, pp. 11-22).

[7] E. T. A. HOFFMANN, *Musikalische Schriften,* herausgegeben von J. E. Freiherr von Grotthuss, Druck und Verlag von Greiner und Pfeiffer, Stuttgart 1906, p. 86; English translation: *E. T. A. Hoffmann's Musical Writings: Kreisleriana; The Poet and the Composer; Music Criticism*, edited by D. Charlton, translated by M. Clarke, Cambridge University Press, Cambridge 1989: «Sollte, wenn von der Musik als einer selbstständigen Kunst die Rede ist, nicht immer nur die Instrumental-Musik gemeint seyn, welche jede Hülfe, jede Beimischung einer andern Kunst (der Poesie) verschmähend, das eigenthümliche, nur in ihr zu erkennende Wesen dieser Kunst rein ausspricht?».

[8] *VMS*, p. 41: «Wir haben absichtlich Instrumentalsätze zu Beispielen gewählt. Denn nur was von der Instrumentalmusik behauptet werden kann, gilt von der Tonkunst als solcher. Wenn irgend eine allgemeine Bestimmtheit der Musik untersucht wird, etwas so ihr Wesen und ihre Natur kennzeichnen, ihre Grenzen und Richtung feststellen soll, so kann nur von der Instrumentalmusik die Riede sein. Was die Instrumentalmusik nicht kann, von dem darf nie gesagt werden die Musik könne es; denn nur sie ist reine, absolute Tonkunst».

[9] Ibid., pp. 43-44: «Wir haben in der Vokalkomposition ein untrennbar verschmolzenes Produkt vor uns, aus dem es nicht mehr möglich ist, die Größe der einzelnen Faktoren zu bestimmen. Wenn es sich um de Wirkung der Dichtkunst handelt, so wird es niemand einfallen, die Oper als Beleg hervorzuheben; es braucht größerer Verleugnung, aber nur derselben Einsicht, um bei den Grundbestimmungen musikalischer Ästhetik ein Gleiches zu tun».

[10] *VMS*, p. 81: «Das Komponieren ist ein Arbeiten des Geistes in geistfähigem Material».

[11] Cfr. C. DAHLHAUS, *Die Idee der absoluten Musik*, Bärenreiter-Verlag, Kassel 1978, p. 44; *The Idea of Absolute Music*, translated by R. Lustig, University of Chicago Press, Chicago 1989.

[12] *VMS*, p. 78: «wir anerkennen keine Schönheit ohne Geist».

[13] In Hegel, art derived its value – both ethical and aesthetic – from the ability to express ideas and concepts, whose character is intrinsically verbal. The aporia of musical signification will be resolved hastily: unable to justify an relationship between instrumental music – whose autonomy was more manifest – and the ideas it expresses, he establishes the primacy of vocal music. Only connected to the word music receives, from the outside, the fullness of meaning otherwise unable to create by itself (Cfr. M. EVAN BONDS, *Absolute Music. The History of an Idea*, Oxford University Press, New York 2014, p. 88 ss.)

[14] There is certainly a convergence between the two views. For Hanslick, as for Schopenhauer, there is no separation between form and content in music. On the other hand, however, Hanslick contradicts Schopenhauer's conception of music: the content of music are not feelings – even if these were 'disembodied' feelings – but only musical ideas (Cfr. K. HIRT, *When Machines Play Chopin: Musical Spirit and*

Automation in Nineteenth-Century German Literature, Walter de Gruyter, Berlin/New York 2010, p. 65 ss.)

15 Cfr. M. MILA, *Cauto omaggio a Hanslick*, in *L'esperienza musicale e l'estetica*, Einaudi, Torino 1956, pp. 15-21. Similar considerations could also be found in: P. KIVY, *Something I've Always Wanted to Know about Hanslick*, in 'The Journal of Aesthetics and Art Criticism', Vol. 46, No. 3 (Spring, 1988), pp. 413-417.

16 *VMS*, p. 29: «[…] die Bestimmtheit der Gefühle von konkreten Vorstellungen und Begriffen nicht getrennt werden kann, welche letztere außer dem Gestaltungsbereich der Musik liegen».

17 C. DAHLHAUS, *Musikästhetik*, Musikverlag Hans Gerig, Köln 1967, p. 50; *Aesthetics of music*, translated by William W. Austin, Cambridge University Press, Cambridge 1982: «Der Formbegriff Kants ist denn auch von dem Eduard Hanslicks so verschieden, daß es irreführend ist, die im gleichen Gedankenzuge zu nennen».

18 This becomes clear also in the light of the fact that the opposition between 'form' and 'content' in the first *Critic*'s Transcendental Analytic is deeply reconsidered in the Analytic of principles, where we are no longer faced with their dichotomy (Cfr. E. CASSIRER, *The Philosophy of Symbolic Forms, Volume One: Language*, translated by R. Mankeim, preface and introduction by C. W. Hendel, Yale University Press, New Haven and London 1980, pp. II-III).

19 I. KANT, *Kritik der Urteilskraft*, in *Kant's Werke*, herausgegeben von der Preußischen Akademie der Wissenschaften, 11 Bände, Walter de Gruyter, Berlin 1968, Band V, p. 211 [from now on *KdU*]; *Critique of the Power of Judgement*, edited by Paul Guyer and Eric Matthew, Cambridge University Press, Cambridge 2000: «Das Schöne ist das, was ohne Begriffe als Object eines allgemeinen Wohlgefallens vorgestellt wird».

20 Ibid., p. 311: «Wenn aber der Gegenstand für ein Product der Kunst gegeben ist und als solches für schön erklärt werden soll: so muß, weil Kunst immer einen Zweck in der Ursache (und deren Causalität) voraussetzt, zuerst ein Begriff von dem zum Grunde gelegt werden, was das Ding sein soll; und da die Zusammenstimmung des Mannigfaltigen in einem Dinge zu einer innern Bestimmung desselben als Zweck die Vollkommenheit des Dinges ist, so wird in der Beurtheilung der Kunstschönheit zugleich die Vollkommenheit des Dinges in Anschlag gebracht werden müssen, wornach in der Beurtheilung einer Naturschönheit (als einer solchen) gar nicht die Frage ist».

21 Ibid., p. 229: «Es giebt zweierlei Arten von Schönheit: freie Schönheit (*pulchritudo vaga*), oder die bloß anhängende Schönheit (*pulchritudo adhaerens*). Die erstere setzt keinen Begriff von dem voraus, was der Gegenstand sein soll; die zweite setzt einen solchen und die Vollkommenheit des Gegenstandes nach demselben voraus».

22 Ibid.: «der bloßen Form nach».

23 Ibid., p. 328: «Sprache der Affecten».

[24] Ibid.: «natürlicher Weise verbunden».

[25] It comes spontaneously to think of Novalis' *Monolog*, which attributes the qualities of instrumental music to language, stressing its self-sufficiency as a differential system of arbitrary signifiers: «[the words] play only with themselves, express nothing but their own wondrous nature and are for that very reason so expressive» (NOVALIS, *Schriften. Die Werke Friedrich von Hardenbergs,* 6 Bände, begründet von P. Kluckhohn und R. Samuel, herausgegeben von P. Kluckhorn und R. Samuel unter Mitarbeit von H. Ritter, G. Schulz und H.-J. Mähl, W. Kohlhammer Verlag, Stuttgart 1960, Band II, p. 672: «[Die Worte] spielen nur mit sich selbst, drücken nichts als ihre wunderbare Natur aus, und eben darum sind sie so ausdrucksvol»).

[26] R. SCHUMANN, *Gesammelte Schriften über Musik und Musiker*, 4 Bände, Georg Wigand's Verlag, Leipzig 1854, Band I, p. 43; *On Music and Musicians*, edited by K. Wolff, translated by P. Rosenfeld, University of California Press, Berkeley and Los Angeles 1983: «die Ästhetik der einen Kunst ist die der andern, nur das Material ist verschieden».

[27] *VMS*, pp. 22-23: «die Schönheitsgesetze jeder Kunst sind untrennbar von den Eigentümlichkeiten ihres Materials, ihrer Technik».

[28] Ibid., cit. pp. 83-84: «Nichts irriger und häufiger, als die Anschauung, welche "schöne Musik" mit und ohne geistigen Gehalt unterscheidet. Sie faßt den Begriff des Schönen in der Musik viel zu eng und stellt sich die kunstreich zusammengefügte Form als etwas für sich selbst Bestehendes, die hineingegossene Seele gleichfalls als etwas Selbständiges vor […]».

[29] Ibid., p. 9: «das Organ, womit das Schöne aufgenommen wird, ist nicht das Gefühl, sondern die Phantasie, als die Tätigkeit des reinen Schauens».

[30] Ibid., p. 75: «Eine vollständig zur Erscheinung gebrachte musikalische Idee aber ist bereits selbstständiges Schöne […]».

[31] *KdU*, p. 314: «diejenige Vorstellung der Einbildungskraft, die viel zu denken veranlaßt, ohne daß ihr doch irgend ein bestimmter Gedanke, d. i. Begriff, adäquat sein kann […] Man sieht leicht, daß sie das Gegenstück (Pendant) von einer Vernunftidee sei, welche umgekehrt Begriff ist, dem keine Anschauung (Vorstellung der Einbildungskraft) adäquat sein kann».

[32] His position could also be interpreted within a different set of historical coordinates, which nonetheless would still confirm a need for synthesis: «Hanslick's goal was not […] to deny idealism, but rather to negotiate a middle ground between idealism and materialism, to theorize what we might describe as 'idealist materialism'. *On the Musically Beautiful* in fact reveals how music, despite the encroachment of positivism, remained a cherished repository for the type of metaphysical desires sentiment put forward by Wienbarg» (M. BURFORD, *Hanslick's Idealist Materialism*, in '19th-Century Music', Vol. 30, No. 2 (Fall 2006), pp. 166-181, cit. p. 167).

[33] Cfr. S. K. LANGER, *Philosophy in a New Key. A Study in the Symbolism of Reason, Rite, and Art*, New American Library, New York 1948.

[34] Cfr. P. KIVY, *Music Alone: Philosophical Reflections on the Purely Musical Experience*, Cornell University Press, Ithaca 1990.

[35] *VMS*, p. 105: «Viele Aesthetiker halten den musikalischen Genuß durch das Wohlgefallen am Regelmäßigen und Symmetrischen ausreichend erklärt, worin doch niemals ein Schönes, vollends ein Musikalisch-Schönes bestand. Das abgeschmackteste Thema kann vollkommen symmetrisch gebaut sein. 'Symmetrie' ist ja nur ein Verhältnißbegriff und läßt die Frage offen: "Was ist es denn, das hier symmetrisch erscheint? – Die regelmäßige Anordnung geistloser, abgenützter Theilchen wird sich gerade in den allerschlechtesten Compositionen nachweisen lassen. Der musikalische Sinn verlangt immer neue symmetrische Bildungen».

[36] P. KIVY, *Antithetical Arts: On the Ancient Quarrel Between Literature and Music*, Oxford University Press, New York 2009, p. 98.

[37] *VMS*, p. 168-169, our cursives: «Der wichtigste Factor in dem Seelenvorgang, welcher das Auffassen eines Tonwerks begleitet und zum Genusse macht, wird am häufigsten übersehen. Es ist die geistige Befriedigung, die der Hörer darin findet, den Absichten des Componisten fortwährend zu folgen und voran zu eilen, sich in seinen Vermuthungen hier bestätigt, dort angenehm getäuscht zu finden. Es versteht sich, daß dieses intellectuelle Hinüber- und Herüberströmen, dieses fortwährende Geben und Empfangen, unbewußt und blitzvoll vor sich geht. Nur solche Musik wird vollen künstlerischen Genuß bieten, welche dies geistige Nachfolgen, welches ganz eigentlich einNachdenken der Phantasie genannt werden könnte, hervorruft und lohnt. Ohne geistige Thätigkeit gibt es überhaupt keinen ästhetischen Genuß».

[38] Ibid., p. 9: «Die Kunst hat vorerst ein Schönes darzustellen Das Organ womit das Schöne aufgenommen wird ist nicht das Gefühl sondern die Phantasie als die Thätigkeit des reinen Schauens».

[39] Ibid.: «Freilich ist die Phantasie gegenüber dem Schönen nicht bloß ein Schauen sondern ein Schauen mit Verstand d. i. Vorstellen und Urteilen lezteres natürlich mit solcher Schnelligkeit daß die einzelnen Vorgänge uns gar nicht zum Bewußtsein kommen und die Täuschung entsteht es geschehe».

[40] «From Kant, we see the foundations, if not the details of Hanslick's formalist viewpoint: non-conceptual, subjective purposiveness of form, arising from a harmonious correlation between the faculties of imagination and understanding, accessible only as phenomenon» (L. ROTHFARB, *Nineteenth-Century Fortunes of Musical Formalism*, in 'Journal of Music Theory' 55, no. 2 (2011), pp. 167-220, cit. p. 195).

[41] *VMS*, p. 10: «[…] so wie sie ihren Lebensfunken aus den Sinne empfindungen zog sendet sie wiederum ihre Radien schnell an die Thätigkeit des Verstandes und des

Gefühls aus Dies sind für die echte Auffassung des Schönen jedoch nur Grenzgebiete».

BIOGRAPHY

Francesco Ragni (Rome, 1986) obtained his PhD in Germanic Languages, Literatures and Cultures at the University of Bologna with a thesis on Nietzsche and early German Romanticism. Since 2017 he has collaborated with the chair of Music's Aesthetics and Forms of Poetry for Music of Roma Tre University. He recently translated and commented Wilhelm Dilthey's essay *The great German music of the Nineteenth Century*.

LOW-FREQUENCY TWO-METER SKY SURVEY RADIAL ARTIFACTS IDENTIFIED AS BROADLINE QUASARS

Antonio J. Paris

Planetary Sciences, Inc.

ABSTRACT

Through the use of a High Band Antenna (HBA) system, the Low Frequency Array (LOFAR) Two-Meter Sky Survey (LoTSS) is an attempt to complete a high-resolution 120-168 MHz survey of the northern celestial sky. To date approximately 5×10^5 radio sources have been classified by LOFAR with most of them consisting of active galactic nuclei (AGNs). The strong AGN emissions detected by LoTSS, it is thought, are powered by supermassive black holes (SMBHs) at the center of galaxies. During an analysis of approximately 1,500 images of these AGNs, we identified ten radio sources with radial spokes emitted from an unknown source. According to LOFAR the radial spokes are artifacts due to calibration errors with no origin, and therefore they cannot be associated with an optical source. Our preliminary hypothesis for the artifacts was that they were produced by ionized jets emitted from quasi-stellar objects (QSOs). Specifically, strong emissions from Type 1 broadline (BL) quasars were directed in the line of sight of the observer (*i.e.*, LOFAR) and as a result produced the image artifacts. To test our hypotheses we cross-referenced the *ra* and *dec* coordinates of the artifacts with the galactic coordinates indexed in the Sloan Digital Sky Survey (SDSS) and confirmed that the artifacts were associated with BL QSOs. Further analysis of the QSOs, moreover, demonstrated that hey exhibited prominent broad emission lines such as C_{III} and Mg_{II}, which are characteristic of Type 1 BL quasars. It is our interpretation, therefore, that the radial spokes characterized as artifacts by LOFAR were produced by the emission of Type 1 BL quasars in the line of sight of the radio telescope.

INTRODUCTION

LoTSS is an ongoing high-resolution 120-168 MHz survey of the northern hemisphere designed (1) to associate or separate cataloged radio components into distinct radio sources and (2) to identify and characterize their optical counterparts.[i] Through the use of LOFAR's HBA system, LoTSS may reach a sensitivity of less than 0.1 mJy beam^{-1} at an angular resolution of ~2 meters across the northern hemisphere.[ii] The primary

scientific objectives of the radio survey are to explore the formation and evolution of ~10^7 radio sources consisting of mostly star-forming galaxies, galaxy clusters, and SMBHs.[iii] The LOFAR source finder computer program, however, inadvertently split hundreds of thousands of the radio sources into multiple separate components. In an effort to reconstruct the full radio sources from their separated components, scientists at LOFAR created the *Radio Galaxy Zoo: LOFAR Project* and solicitated the assistance of volunteer citizen scientists to classify and index the radio sources visually.[iv] As of August 2020, the survey had covered ~3,000 square degrees of the sky and cataloged ~5×10^5 radio sources, and staff at LOFAR had analyzed ~80,000 of them.[v]

ACTIVE GALACTIC NUCLEI

The majority of known radio sources in the LOFAR radio survey are AGNs.[vi] These types of active galaxies have a compact region at their center with a higher-than-normal luminosity over at least some portion of the electromagnetic spectrum when compared to an otherwise typical galaxy.[vii] The excess non-stellar emissions from these extragalactic emitters can be observed in the radio band (*i.e.*, LOFAR), as well as through microwave, infrared, optical, ultraviolet, x-ray, and gamma ray wavebands. The non-stellar radiation emitting from AGNs is theorized to result from the accretion of matter by a SMBH at the center of its host galaxy.[viii]

In some instances the SMBHs of AGNs produce narrow beams of high-energetic particles and eject them outward in opposite directions away from the disk (Figure 1a). These powerful jets, which emerge at nearly the speed of light, spread out up to hundreds of kiloparsecs outside the host galaxies and form distinctive radio lobe structures commonly referred to as "straddling the galaxy" (Figure 1b and 1c).[ix] The lobes are often connected by a narrower bridge of radio emission produced by the jets. If the narrow jets are visible, the optical counterpart source is generally halfway between the two lobes, and it can be cross-referenced with other spectral databases, such as SDSS (Figure 1d).[x]

LOFAR ARTIFACTS

On 19 February 2019 LOFAR released the first dataset (DR1) collected by LoTSS, which covered 424 square degrees of the northern sky and included over ~3 × 10^5 radio sources.[xi] After numerous visual sorting stages ~2,543 of the LoTSS images were flagged with artifacts. These artifacts, referred to by LOFAR staff and several citizen scientists as "explosions," are generally near the vicinity of bright sources in the LoTSS

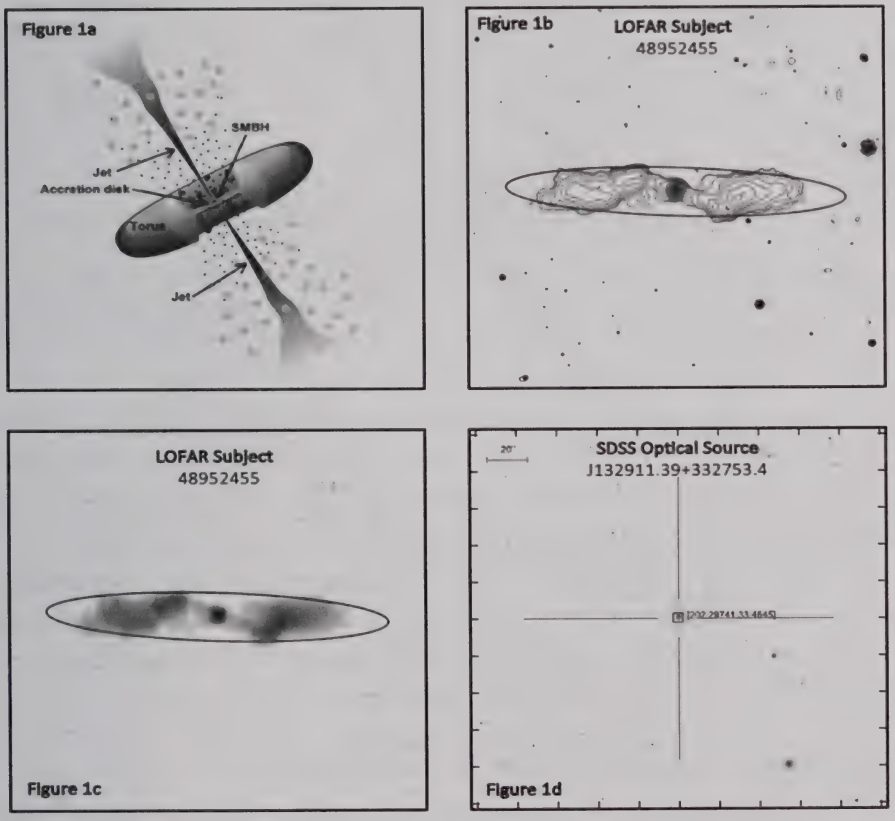
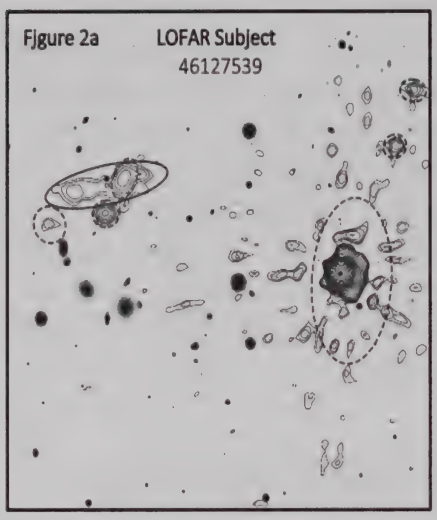


Figure 1: A NASA illustration of an AGN emitting ionized jets (1a) compared to an AGN (subject 48952455) cataloged by LOFAR (1b with artificial counters, 1c radio). The AGN's optical counterpart, identified as a starforming galaxy, is indexed in the SDSS database (1d)



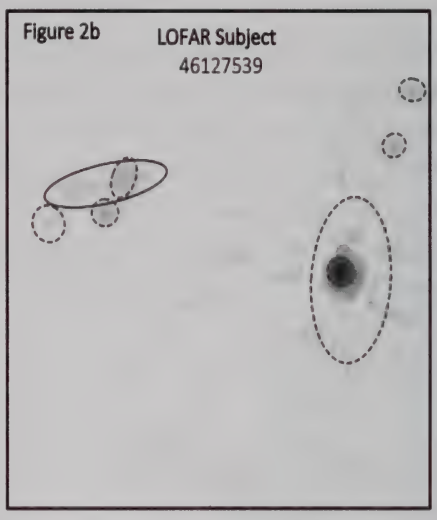


Figure 2: An example of a radio image with artifacts observed by the LOFAR survey (2a) with artificial counters, (2b) in radio. The artifacts, according to LOFAR, appear as radial "explosions" emitted from an unknown bright source located at ra: 352°.284369, dec: 18°.576822.

radio image (Figure 2a and 2b). According to LOFAR, the dynamic range limitations in the imaging are responsible for the artifacts. Moreover, per the LOFAR Field Guide, bright radio sources cause radio contours to appear that have no real origin and therefore cannot be associated with an optical source. The images with the artifacts were dropped from further analysis by staff at LOFAR and were not included in the final LoTSS-DR1 catalogue. Furthermore, no clarification regarding the direct source of the artifacts other than an unknown bright source was provided.

QUASI STELLAR OBJECTS

Our preliminary hypothesis for the source of the LOFAR artifacts was quasars. Specifically, we hypothesized that the ionized jets emitted from a radio-load quasar were in the line of sight of the LOFAR radio telescope, and, as a result, produced the artifacts. Quasars, also referred to as quasi-stellar objects, are the most powerful subclass of AGNs. They have strong radio emissions and optically have a starlike visual appearance.[xii] The radiation emitted by SMBHs at the center of quasars is among the most luminous, powerful, and energetic phenomena known in the universe.[xiii]

Quasars are further defined based on their observed characteristics, such as how the ionized jets and gases emitted from the disk are oriented to the observer (Figure 3). Radio-load quasars have the most powerful jets and are strong sources of radio-wavelength emission.

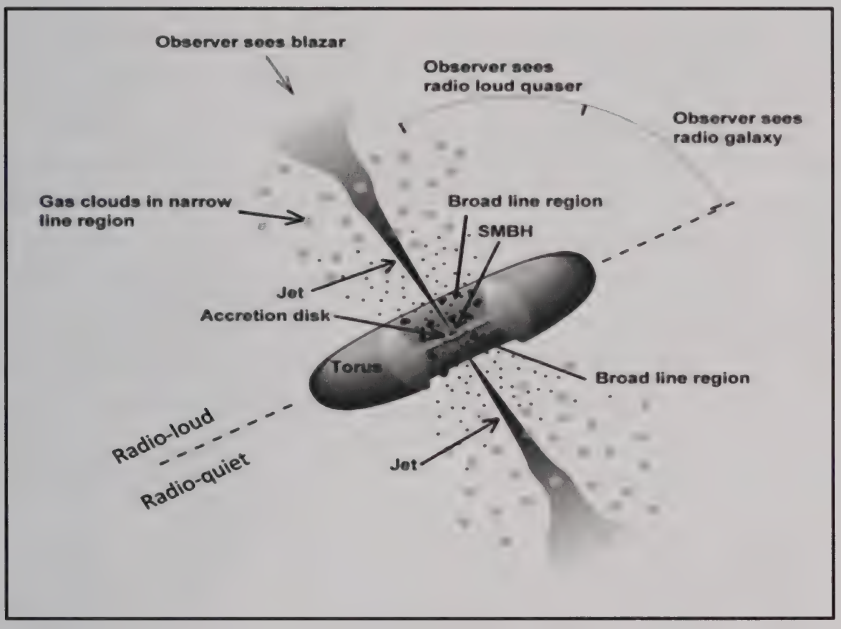


Figure 3: An illustration demonstrating how the orientation of emissions from AGNs are defined (source: NASA).

In contrast, radio-quiet quasars have weaker yet still powerful jets, with relatively weaker radio emissions from the SMBHs.[xiv] Blazars, which are rare, are radio-loud quasars with relativistic jets directed in the line of sight of an observer.[xv]

BL quasars are a subset of quasars whose optical spectra emission lines are believed to come from high-velocity gas in the broadline region (BLR), ~0.1-1 pc from the central engine of the SMBH (Figure 3).[xvi] BL quasars are further categorized as Type 1 objects because they display broad lines in their unpolarized spectra, have a low inclination angle with respect to the accretion disk axis, and consequently enable an unobscured view of the central engine.[xvii] The optical spectra of BL quasars, moreover, exhibit prominent broad emission lines but rather weaker narrow lines. Prominent

broad emission lines in BL quasars include CIII and MgII. Moreover, Lyman alpha emission lines arise from the electronic transition in atomic hydrogen from the state $n = 2$ to $n = 1$.[xviii] This line, which occurs at a wavelength of 121.6 nm, typically indicates very strong Type 1 BL quasars.

CROSS-MATCHING LOFAR ARTIFACTS WITH THE SLOAN DIGITAL SKY SURVEY (SDSS)

Our assumption regarding the source of the LOFAR artifacts is they are associated with ionized gas emitted from the BLR of quasars. To corroborate our hypotheses, we cross-matched the *ra* and *dec* coordinates of ten LOFAR radio sources (with artifacts) with SDSS—a multi-spectral imaging survey that uses a 2.5-m wide-angle optical telescope.[xix] Cross-matching radio signatures with SDSS is a well-established procedure in astronomy. For many radio sources, such as quasars, emissions are relatively compact and are analogous with their optical counterparts, allowing

LOFAR Artifact ID	LOFAR Ra	LOFAR Dec	SDSS Object ID	Quasar Type	Galactic Coordinates *l*	Galactic Coordinates *b*
44118344	0.153533	29.241163	1237680331640209529	BLQ	109.797043	-32.3280304
44120630	8.695916	33.488398	1237673072594911468	BLQ	118.949151	-29.2375322
44209850	236.658701	36.740359	1237662474227810333	BLQ	58.772973	51.9544549
47773327	22.497927	17.102729	1237678601851502861	BLQ	135.983923	-44.7853478
44128911	336.613764	23.346522	1237680301029065381	BLQ	84.718632	-28.5644715
50911574	24.196933	28.678306	1237680332723126683	BLQ	134.789731	-33.1580088
48239351	141.468759	36.213063	1237660962404106339	BLQ	187.770071	45.8434456
48192498	150.318035	34.429497	1237664668433318086	BLQ	190.890222	52.9883760
44128422	334.433215	29.643024	1237680329484272602	BLQ	87.209568	-22.3334179
46127539	352.284369	18.576822	1237680245200585117	BLQ	97.078260	-40.1246700

Table 1: A sampling of 10 LOFAR radio source artifacts cross-matched and confirmed as BL quasars indexed in SDSS.

unpretentious cross-matching. The optical counterpart for LOFAR radio subject 44118344 (Figure 4a), for illustration, was indexed in SDSS (Figure 4b) and, as we suspected, was classified as a Type 1 BL quasar. The broad emission lines MgII in optical and CIII in the near infrared, which are characteristic of Type 1 BL quasars, are also visible in the SSDS spectra (Figure 4c), supporting our hypothesis that the emission from 44118344 came from a BL quasar. Likewise, when we cross-matched the remaining nine LOFAR subjects (with artifacts) in SDSS, we confirmed they too were

indexed as Type 1 BL quasars (Table 1 and Appendix 1) with accompanying spectra (Table 2) characteristic of these objects.

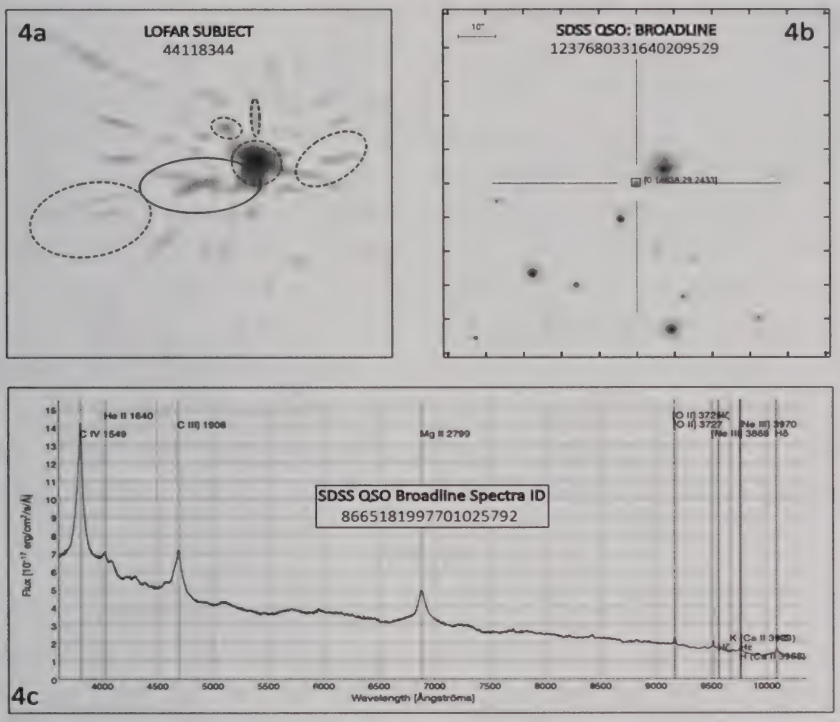


Figure 4: A crossmatch of LOFAR subject 44118344 (4a) with a BL quasar indexed in SDSS (4b). The spectra (4c) fit a BL quasar.

LOFAR Artifact	SSDS Sprectral ID	Quasar Type	Prominent Broad Emission Lines Wavelength [Ångströms]		
			C III 1980	MG II 2799	Redshift *z*
44118344	8665181997701025792	BLQ	4690.294	6883.353	1.459
44120630	7352158936949346304	BLQ	6156.019	9019.886	2.228
44209850	1594412579910871040	BLQ	3821.222	5447.536	0.941
47773327	5995206854356742144	BLQ	3932.789	5768.994	1.059
44128911	8537969040429436928	BLQ	5678.862	8311.892	1.969
50911574	7053769068508368896	BLQ	3682.136	5395.108	0.928
48239351	8468973069483618304	BLQ	3815.926	5591.135	0.998
48192498	6926359617319186432	BLQ	3729.065	5451.299	0.946
44128422	8609971395701788672	BLQ	5476.463	8011.247	1.865
46127539	8561389187672330240	BLQ	3709.368	5470.159	0.952

Table 2: 10 LOFAR radio artifacts with spectra characteristic of BL quasars (source: SDSS).

CONCLUSIONS

LoTSS has made considerable gains in achieving its goal of cataloging and cross-matching thousands of AGNs in the northern hemisphere. In some instances, however, the limitations of the two-meter telescope resulted in artifacts that were not thoroughly identified by LOFAR. To identify the source of the artifacts, we examined ten LOFAR radio sources that exhibited artifacts and cross-matched them with the multi-spectral imaging survey SDSS. As we initially suspected, we identified the source of the artifacts as radio-loud quasars. Moreover, scrutiny of the data indexed in SDSS showed that the LOFAR telescope was in the line of sight of the BLR of the ten quasars. We make the latter assumption from an analysis of the accompanying spectra in SDSS, which exhibited prominent broad emission lines CIII and MgII, which are characteristic of Type 1 BL quasars. It is our interpretation, accordingly, that the radial spokes categorized as artifacts by LOFAR were produced by the emission of QSOs.

NOTES

The Radio Galaxy Zoo: LOFAR Project is part of *Radio Galaxy Zoo* (RGZ)—an internet crowdsourced citizen science project attempting to locate SBMHs in distant galaxies. The programs are hosted by the web portal *Zooniverse*. Using many classifications provided by citizen scientists, as well as professional scientists, it hopes to build a more complete picture of black holes at various stages and their origins.[xx]

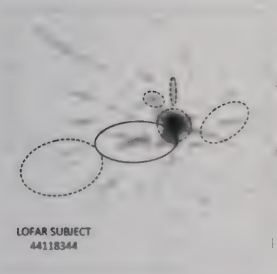
BIOGRAPHY

Antonio Paris, the Principal Investigator (PI) for this study, is the Chief Scientist at Planetary Sciences, Inc. and an Assistant Professor of Astronomy and Astrophysics at St. Petersburg College, FL. Prof. Paris is a professional member of the Washington Academy of Sciences, the American Astronomical Society, and the Explorer's Club.

CONTRIBUTIONS

Dennis Farr, who currently serves as President at the Society of Amateur Radio Astronomers, assisted with cross-matching SDSS data during investigation.

APPENDIX 1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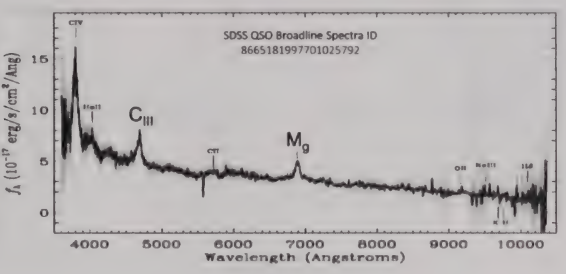
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C III
CIII
M g
OII
NeIII
H δ
Wavelength (Angstroms)

LOFAR SUBJECT
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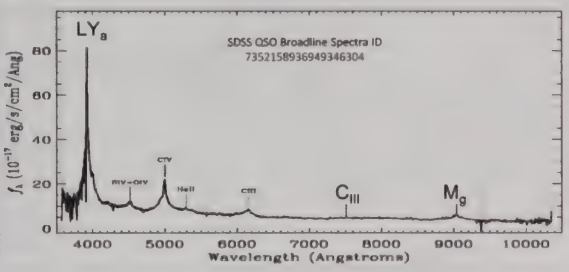
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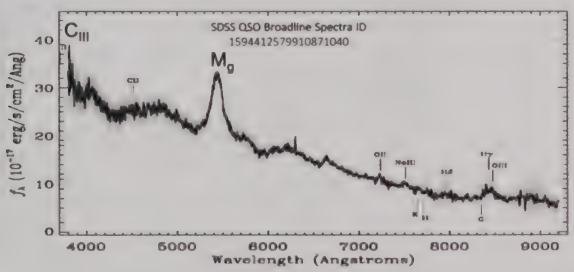
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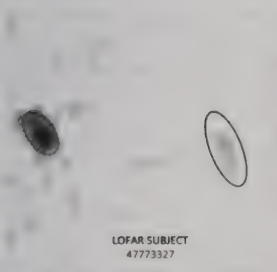
NeIII
H δ
Wavelength (Angstroms)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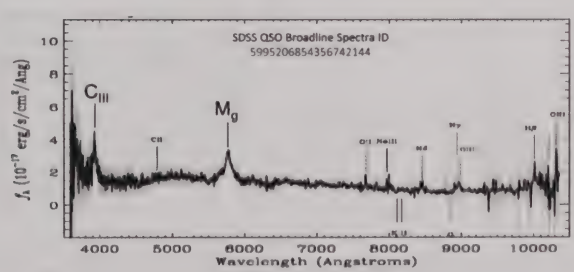
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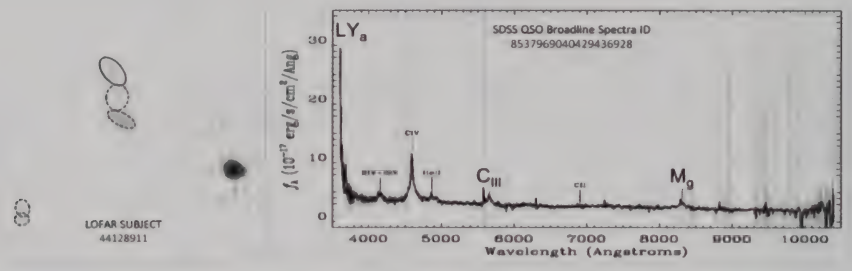
M g
CIII
OII
NeIII
Hγ
Hβ
Wavelength (Angstroms)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M_g
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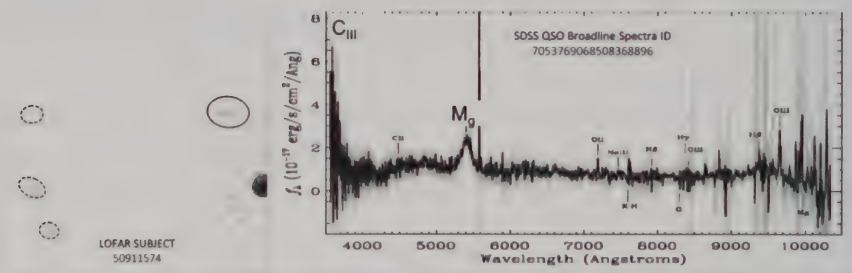
Wavelength (Angstroms)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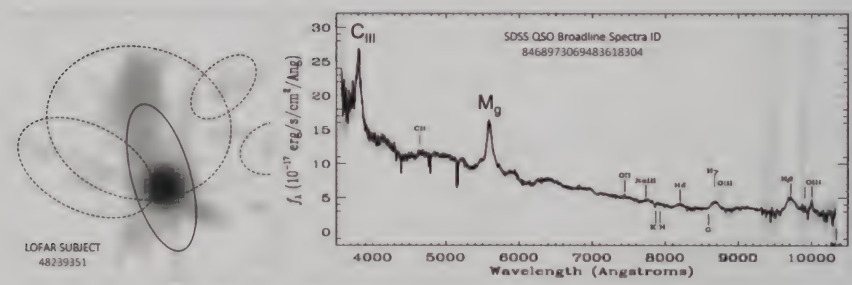
Wavelength (Angstroms)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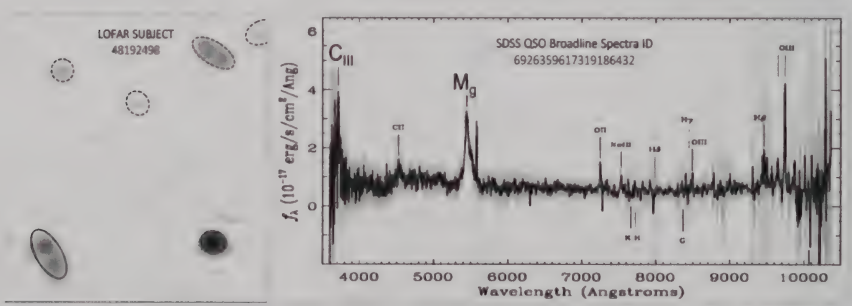
Wavelength (Angstroms)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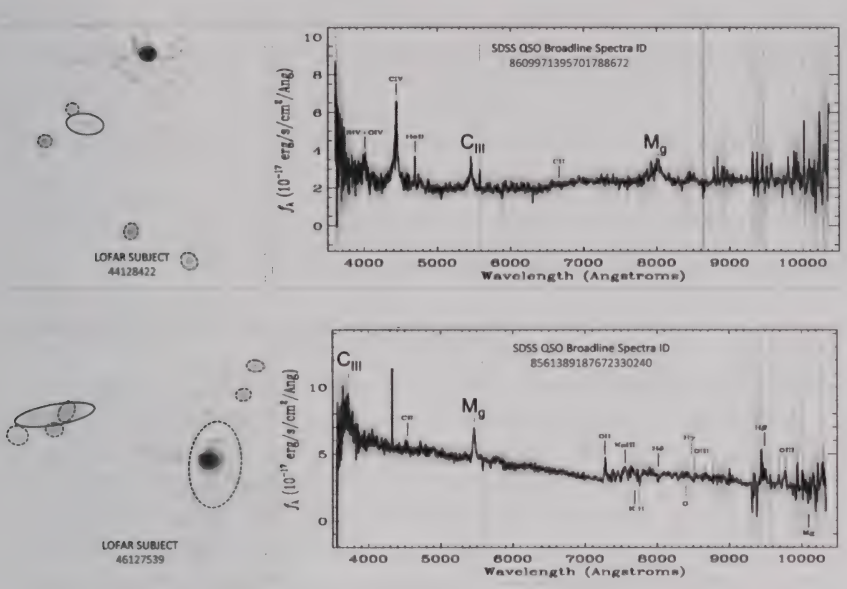
Wavelength (Angstroms)



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NEW SCALAR FORCE FROM TRANSFORMATION OF PLANCK'S BLACKBODY RADIATION LAW

Thomas S. Kakovitch*, Russell R. Vane III**, Byunggu Yu*, David R. Lambert, Jr.*

*University of the District of Columbia, **Fusion Energy Partners, LLC

ABSTRACT

This paper provides an approach to transform Planck's blackbody radiation law for any arbitrary interval of upper and lower wavelengths (and associated frequencies) into a solely temperature dependent function. Temperature functions are scalar. This study is intended to solve for temperature dependent scalar functions and connect them to the four-dimensional Riemannian space specifically with regard to Einstein's field equations. This narrative is necessary to illustrate the existence of an invariant scalar force field in nature.

INTRODUCTION

THE FOUR FUNDAMENTAL FORCES IN NATURE: strong nucleic, electro-weak, and gravity are the by-product of an extremely hot primordial radiation dominated era where small but finite regions of space were permeated with a scalar temperature field. The present day cosmic microwave radiation background is the cooler remnant of a primordial radiation dominated era. It is conceivable that the four fundamental forces are the components of an original invariant scalar force field belonging to Planck's black body radiation family.

MATHEMATICAL ANALYSIS

The relation between the emissive power of a blackbody and energy density of radiation according to the methods of statistics appears to depend on two sets of variables, either frequency and temperature, or wavelength and temperature. The question to ask is how can one set blackbody equations be solely temperature dependent? A temperature function is a scalar. The energy density calculations according to the method of statistics are described in terms of a Bose-Einstein distribution function:

$$f(\varepsilon) = \frac{1}{e^{\varepsilon/KT} - 1} \quad \text{where} \quad \varepsilon = h\nu \,. \tag{1}$$

In Equation (1) ε is energy of the boson; K is the Boltzmann constant; T is temperature, h is Planck's constant; and ν is frequency. Equation (1) represents the average number of photons in a particular state of energy and its equivalent frequency, ν. To find the number of photons with energies in an interval $\varepsilon + d\varepsilon$ or $\nu + d\nu$, one multiplies the number of available energy states $g(\varepsilon)$ in these intervals by the Bose-Einstein distribution function. The radiation energy per unit volume is the integration over all frequencies or all wavelengths. This is referred to as the blackbody radiation law or the Planck radiation equation:

$$\varepsilon_\nu = \frac{8\pi h\nu^3}{c^3}\frac{1}{e^{h\nu/KT}-1}. \tag{2}$$

For $h\nu / KT << 1$ the Planck equation reduces to the Rayleigh-Jeans[1] formula for radiation for high frequencies, or toward the ultraviolet, which is contrary to experience.

For $h\nu / KT =$ constant the Planck equation reduces to the Wien[2] formula for radiation with maximum energy distribution.

For un-polarized radiation the emissive power of a blackbody in the range $d\nu$ becomes the Planck radiation law, where the dependence of intensity upon frequency for black body radiation is given by the formula[3,4]

$$\frac{h\nu^3}{c^2}\frac{1}{e^{h\nu/KT}-1}d\nu \tag{3}$$

or in wavelength units

$$\frac{hc^2}{\lambda^5}\frac{1}{e^{hc/KT\lambda}-1}d\lambda. \tag{4}$$

This paper provides an approach to transform Planck's blackbody radiation law for any arbitrary interval of upper and lower wavelengths (and associated frequencies) into a solely temperature dependent function.

Let "*p*" and "*u*" be arbitrary upper and lower wavelength (λ) limits of Formula (4) and let "*ss=c/p*" and "*qq=c/u*" be the associated upper and lower frequency (ν) limits of Formula (3). Then, by solving the definite integral of Formula (3) between *ss* and *qq*, one can have a solely temperature dependent function (see appendix for a solution example).

The ratio of this solution with respect to the "Norm" of the definite integral of Formula (4) between the associated wavelength limits p and u (see appendix) gives a scalar temperature function converging to the product of the Minkowski's coefficient of the fourth axis component:

$$x_4 = ict : (ic)^4 = c^4, \tag{5}$$

where c is the speed of light and i is the imaginary unit.

The concept of the parallel displacement of a vector is fundamental to the geometric basis of the tensor calculus in Riemannian space. Let us assume that the direction of a curve $x^k = x^k(t)$ at any point P is characterized by the tangent vector u^i. The geodesic line is a curve that always maintains its direction through a parallel displacement of the appropriate tangent vector u^i along the line for which[3]:

$$g_{ik} u^i u^k = -c^2 . \tag{6}$$

By comparing Equation (5) to Equation (6) we find the ratio of the solution of the definite integral of Equation (3) with respect to the Norm of the definite integral of Equation (4) is the square of the expression that defines conditions of the parallel displacement:

$$\left(g_{ik} u^i u^k\right)^2 = c^4. \tag{7}$$

The exact identical convergence of finite solutions presented by Equation (5), and parallel displacement of a tangent vector that describes the direction of the geodesic curve presented by Equation (7) satisfies both the conditions of invariance and Lorentz transformation.

The dimensional analysis follow-up to Equation (5) is that an invariant scalar force that permeates the four-dimensional space-time continuum is solely temperature dependent and takes the form[3]

$$U(T) = c^4 / G. \tag{8}$$

Since both c and G are constant and invariant scalars, the force $U(T)$ is an invariant scalar as well. Figure 1 contains a plot of $U(T)$ in dynes over the temperature domain of zero to three Kelvin. The two sawtooth sub-regions are being investigated. Figure 2 contains a plot of $U(T)$ in dynes over the temperature domain of zero to ten Kelvin.

CONCLUSION

Einstein's field equation is described as[3]:

$$R_{mn} - \frac{1}{2} g_{mn} R + \Lambda g_{mn} = -\frac{8\pi G}{c^4} T_{mn}, \tag{9}$$

where R_{mn} is the Ricci curvature tensor, g_{mn} is the metric tensor, R is the scalar curvature, Λ is the cosmological constant, and T_{mn} is the stress energy tensor.

By comparing Equations (8) and (9) we find the constant of equivalence between the curvature of space-time and the stress-energy-momentum tensor coincide with the term $U(T) = c^4/G$ expressed in Einstein's field equations.

To have a dimensional equivalence between the two sides of Equation (9), it is more comprehensible to rewrite Einstein's field equations as:

$$U(T)\left(R_{mn} - \frac{1}{2} g_{mn} R + \Lambda g_{mn} \right) = -8\pi T_{mn}. \tag{10}$$

The invariant scalar force $U(T)$ is meaningful in that it represents the total radiated energy across the four-dimensional domain.

APPENDIX

We start with Equation (3) and integrate between qq and ss:

$$\int_{qq}^{ss} \left(\frac{h\nu^3}{c^2} \frac{1}{e^{h\nu/KT} - 1} \right) d\nu$$

To integrate Equation (3) we require a general approach, rather than a direct symbolic lookup and assignment. We use the software package *Mathematica* for this.

Mathematica supports zeta and polylogarithm functions of a complex variable in full generality, performing efficient arbitrary-precision evaluation and employing extensive symbolic transformations.

We use *Mathematica* to integrate Equation (3) as a definite integral; the method is fully provided in Kakovitch (2012) on pages 24-26. The

"ConditionalExpression" is used only to minimize output in the paper. The ratio of the solution to Equation (3) with respect to the Norm of the definite integral of the equation (4) becomes:

ConditionalExpression

$$\left\{\frac{1}{4h^4}\left[\begin{array}{l} -h^4qq^4+4h^3Kqq^3T\log\left(1-e^{hqq/KT}\right)-4h^3ss^3T\log\left(1-e^{hss/KT}\right) \\ +12h^2K^2qq^2T^2\text{polylog}\left(2,e^{hqq/KT}\right)-12h^2K^2ss^2T^2\text{polylog}\left(2,e^{hss/KT}\right) \\ -24hK^3qqT^3\text{polylog}\left(3,e^{hqq/KT}\right)+24hK^3ssT^3\text{polylog}\left(3,e^{hss/KT}\right) \\ +24K^4T^4\text{polylog}\left(4,e^{hqq/KT}\right)-24K^4T^4\text{polylog}\left(4,e^{hss/KT}\right) \end{array}\right]\right\}$$

where $e^{hss/KT}\le 1$ and $e^{hqq/KT}\le 1$

$$/\boldsymbol{Norm}\left(\int_u^p \frac{1}{\lambda^5}\cdot\frac{1}{e^{hc/kT\lambda}-1}\,d\lambda\right)=c^4$$

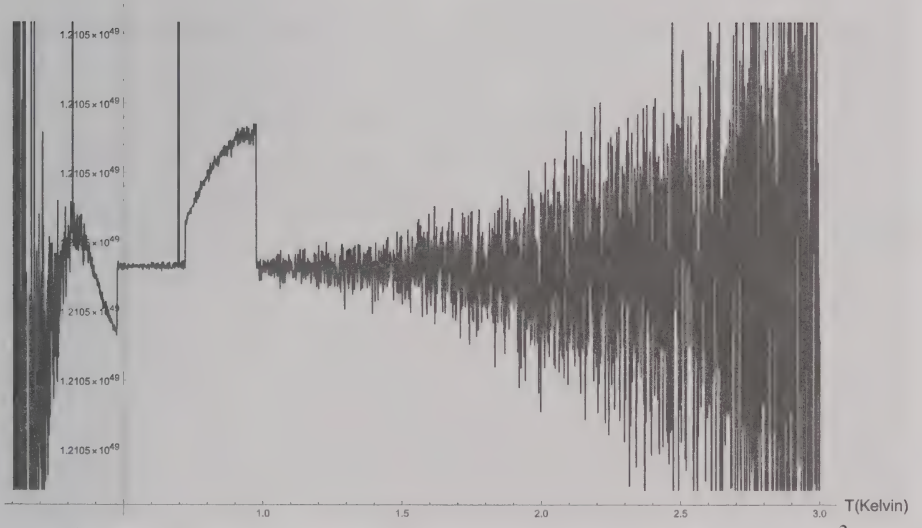

Figure 1 Plot of Equation (8) between 0 and 3 degrees Kelvin[3]

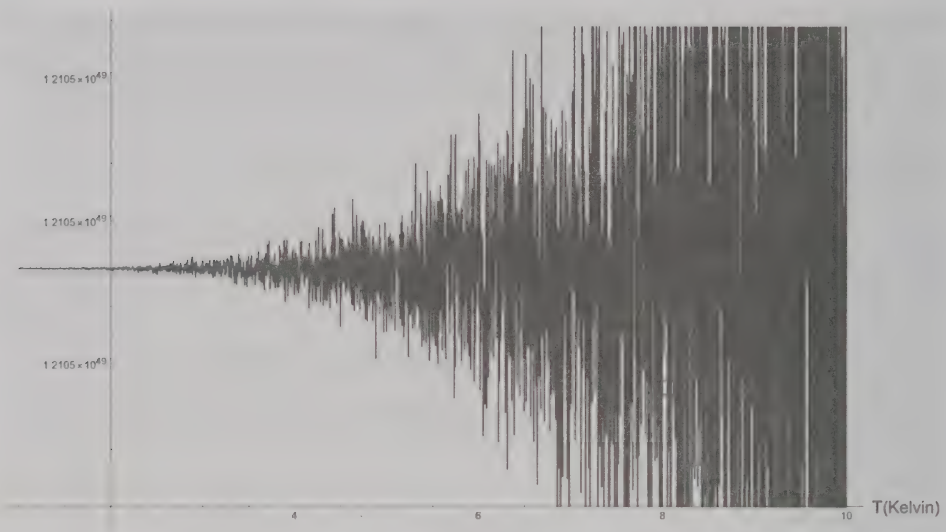

Figure 2. Plot of Equation (8) from 0 to 10 degrees Kelvin [4]

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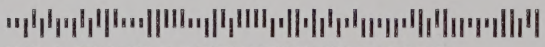

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